REMARKS

Claims 1-10 and 12-53 are pending. Applicants respectfully request that the Examiner reconsider the pending rejection in view of the following remarks.

Claims 12-14, 16-18, and 31-36 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Dierickx (U.S. Patent No. 7,106,373) ("Dierickx"). The rejection is respectfully traversed.

Claim 12 recites a method for operating a pixel circuit comprising "applying a first saturation control signal at a first voltage level to a transfer transistor to remove some accumulated charge from said photodiode to a storage node; applying a second saturation control signal to the transfer transistor to remove additional accumulated charges from said photodiode; and applying a reset pulse to a reset transistor…."

By contrast, Dierickx discloses a pixel circuit in which charge is removed from a charge storage node 37 associated with a photodiode 32 to a reset voltage line via a reset transistor 31 modulated by a "reference" voltage applied to a "reference" transistor between the photodiode and the reset transistor. (Dierickx, FIG. 3 and Column 6, Lines 51-64)

In making the rejection of claim 12 over Dierickx, the Office Action characterizes the "reference" transistor of Dierickx as a "transfer transistor" by interpreting the term "transfer transistor" as any transistor that transfers charge. (Page 3) This is contrary to Applicants' specification and established claim construction principles.

Throughout Applicants' specification, the term "transfer transistor" is used exclusively to refer to a transistor coupled between the photodiode and the column output line. (See, for example, FIG. 2A, Element 103.) Other terms, such as "reset transistor," "row select transistor," and "source follower transistor," are used to refer to other transistors. All of these transistors transfer charge yet none is referred to as a "transfer transistor." Interpreting "transfer transistor" as generic for any transistor that transfers charge (i.e., all transistors) is contrary to the Applicants' consistent use of the term "transfer transistor" to refer to a specific one of the transistors in the disclosed pixel design. In claim 12, too, Applicants use the terms "transfer transistor" and "reset transistor" repeatedly. If "transfer transistor" was in fact generic for any transistor, as the Office Action asserts, then the word "transfer" in the claims would be rendered superfluous, an interpretation contrary to established claim construction principles. See, e.g., *Merck & Co. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1372 (Fed. Cir. 2005) ("A claim construction that gives meaning to all the terms of the claim is preferred over one that does not do so.") and *Power Mosfet Techs., L.L.C. v. Siemens AG*, 378 F.3d 1396, 1410 (Fed. Cir. 2004) (stating claim interpretations that render claim terms superfluous are generally disfavored).

Thus, given the proper interpretation of "transfer transistor" (i.e., the one expressly disclosed in Applicants' specification and required by the Federal Circuit's disfavoring of superfluous claim terms), Dierickx does not disclose Applicants' claimed invention. Dierickx does not disclose applying a voltage to the transfer transistor during the intergration period, as claimed by Applicants, but rather Dierickx teaches applying a voltage to a "reference" transistor used to modulate a reset transistor. This "reference" transistor is not coupled between the photodiode and the column output line, as is a transfer transistor, but rather between the photodiode and a reset voltage line.

Although Applicants believe it to be unnecessary and redundant, Applicants will entertain the possibility of amending the claims to recite expressly that the transfer transistor is "coupled between the photodiode and the column output line" (or such other limitation as has proper antecedent basis given other elements of each claim). Applicants have not so amended the claim now because they believe such amendment is unnecessary given the above and that the Examiner would, in any event, refuse to enter the amendment given the procedural posture of this application.

Dierickx also fails to disclose "remov[ing] some accumulated charge from said photodiode to a storage node," as recited by claim 12. To the contrary, Dierickx teaches, "the charge storage node (37)(47) is reset to a level determined by the reference voltage." (Col. 6, Lines

61-62) Thus, Dierickx does not transfer accumulated charge "*to* a storage node" but rather transfers charge *from* a storage node out through the reset voltage line. Dierickx teaches precisely the opposite of what Applicants claim.

For at least all of these reasons, Dierickx fails to anticipate every limitation of claim 12. Therefore, the rejection of claim 12 over Dierickx should be withdrawn and the claim allowed.

Claims 13, 14, and 16-18 depend from claim 12 and are allowable over Dierickx for at least the reasons stated above with respect to claim 12 and on their own merits. Therefore, the rejection of claim 13, 14, and 16-18 should be withdrawn and the claims allowed.

Claim 31 recites limitations similar to claim 12 discussed above but also recites "a floating diffusion region, coupled to a reset node through a reset transistor…."

In response to Applicants' argument that the area between Dierickx's "reference" transistor and reset transistor (31) is not a "floating diffusion region," the Office Action states that "no basis has been given for this argument." (Page 3) Applicants respectfully submit that the burden is on the Examiner to establish that a reference meets every limitation of the claims and not on the Applicants to prove that it does not. The Office Action fails to provide any citation within Dierickx describing the area between the "reference" transistor and the reset transistor (31) as a floating diffusion region. Instead the Office Action merely cites "Figure 3". A electronic search of the Dierickx specification reveals no mention whatsoever of a "floating diffusion region". Therefore, Applicants respectfully suggest that the Office Action's assertion that the area between the "reference" transistor and the reset transistor (31) is a "floating diffusion region" is unfounded.

For at least this reason and the other reasons detailed above with respect to claim 12, Dierickx fails to anticipate every limitation of claim 31. Therefore, the rejection of claim 31 over Dierickx should be withdrawn and the claim allowed.

Claims 32-36 depend from claim 31 and are believed to be allowable over Dierickx for at least the reasons stated above with respect to claim 31 and on their own merits. Therefore, the rejection of claims 32-36 should be withdrawn and the claims allowed.

Claims 1-5 and 8-10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dierickx in view of Raynor et al. (U.S. Pub. No. 2002/0114025) ("Raynor"). The rejection is respectfully traversed.

Claim 1 recites "turning on a transfer transistor to remove some of said accumulated photo-generated charge to a floating diffusion node; turning on a reset transistor to remove said some of said accumulated photo-generated charge from said floating diffusion node; and producing an output signal based at least in part on accumulated charges in the floating diffusion region existing at the end of said integration period."

The Office Action correctly acknowledges that "Dierickx discloses the use of a 3T pixel which does not include a transfer transistor as claimed." Applicants respectfully point out that the Office Action is internally inconsistent with regard to what Dierickx does and not does disclose. In rejecting claim 12 and in responding to Applicants' prior remarks, the Office Action asserts, "Since transistor 37 transfers charge, it is broadly considered a 'transfer transistor' as claimed." (Page 3) In rejecting claim 1, however, the Office Action acknowledges, "Dierickx ... does not include a transfer transistor as claimed." A single reference cannot simultaneously disclose and fail to disclose an element. For at least all of the reasons detailed above with respect to claim 12, Applicants believe the Office Action is correct to conclude Dierickx does not disclose the claimed transfer transistor.

In any event, the Office Action correctly acknowledges that Dierickx does not disclose all of the limitations of claim 1. Therefore, the Office Action relies on Dierickx in combination with Raynor. Raynor is cited merely as disclosing an exemplary 4T pixel design and "that it is desirable to minimize the area of the pixel circuitry." (Pages 7-8) Applicants do not dispute that 4T pixels were known in the art prior to Applicants' disclosure or that reducing pixel circuit size is one relevant design consideration. Applicants do dispute, however, that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the reference voltage of Dierickx to the transfer transistor M4 of Raynor...." (Page 8)

In Dierickx, a reset transistor (31) is modulated by a "reference" voltage is applied to a "reference" transistor. (FIG. 3 and Column 6, Lines 51-64) In Raynor, the transfer transistor M4 acts as a shutter between the photodiode V_{pd} and readout elements, such as source-follower transistor M1 and row select transistor M3. (FIG. 4) These transistors – the "reference" transistor of Dierickx and the transfer transistor of Raynor – perform substantially different functions and are included in their respective pixel designs for substantially different reasons. The "reference transistor" of Dierickx modulates a reset voltage to control the extent to which charge accumulated at a photodiode is removed through a reset voltage line. The transfer transistor of Raynor controls the flow of charge to a column output line for use in image formation. It would not have been obvious to apply a signal intended to modulate a reset voltage to a transistor intended to act as a shutter between charge-generating and readout elements. Indeed, applying the "reference" voltage of Dierickx to the transfer transistor of Raynor would have caused charge to leak across the transfer transistor and seemingly defeat the purpose of the transfer transistor (i.e., to isolate the charge-generating photodiode during integration).

Neither Dierickx nor Raynor teaches or suggests "turning on a transfer transistor to remove some of said accumulated photo-generated charge to a floating diffusion node; turning on a reset transistor to remove said some of said accumulated photo-generated charge from said floating diffusion node; and producing an output signal based at least in part on accumulated charges in the floating diffusion region existing at the end of said integration period." To the contrary, Dierickx teaches discarding – not reading out – the charge removed to the area between the "reference transistor" and element (31), and Raynor is silent with respect to applying a voltage to the transfer transistor during the integration period.

The Office Action also fails to address all the limitations of claim 1. For example, the rejection makes no mention of a floating diffusion region at all and certainly does not address removing "accumulated photo-generated charge from said floating diffusion node" and "producing an output signal based at least in part on accumulated charges in the floating diffusion region," as claim by Applicants. To the contrary, the Office Action merely points out that Dierickx discloses "accumulating a photo-generated charge during an integration period," "removing some of the accumulated photo-generated charges during the integration period," and "producing an output signal based on accumulated charges existing at the end of the integration period." Applicants do not dispute this but respectfully submit that these are not the limitations of claim 1.

In particular, the Office action fails to mention the "floating diffusion node" limitation while making out the rejection of claim 1 on pages 7 and 8. By failing to address this limitation, the Office Action overlooks a distinction between the cited prior art and the claimed invention. Claim 1 requires that a "transfer transistor" be turned on "to remove some of said accumulated photo-generated charge to a floating diffusion node...." With respect to claim 1, the Office Action does not indicate where this "floating diffusion node" is found in Dierickx. However, in responding to Applicants' prior remarks on page 2, the Office Action implies the "floating diffusion node" is found between the "reference transistor" and element (31) of Dierickx FIG. 3. Applicants agree some charge flows between the "reference transistor" and element (31) when the "reference transistor" is turned at least partly on. However, Dierickx does not "produc[e] an output signal based at least in part on accumulated charges in the floating diffusion region," because the charge flowing between the "reference transistor" and element (31) is discarded out the reset voltage line, not output through the column output line. Discarding a charge through a reset voltage line is not "producing an output signal" as recited in claim 1.

For at least all of these reasons, Dierickx and Reynor fail to disclose or render obvious every limitation of claim 1. Therefore, the rejection of claim 1 over Dierickx and Raynor should be withdrawn and the claim allowed.

Claims 2-5 and 8-10 depend from claim 1 and are allowable over the Dierickx and Raynor combination for at least the reasons stated above with respect to claim 1 and on their own merits. Therefore, the rejection of claims 2-5 and 8-10 should be withdrawn and the claims allowed.

Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dierickx in view of Raynor in further view of Ueno (U.S. Patent No. 6,342,920) ("Ueno"). The rejection is respectfully traversed.

Claim 6 depends from claim 4 and adds the further limitation that "said signal characteristic is a signal pulse width." Claim 7 also depends from claim 4 and adds the further limitation that "said signal characteristic is a signal pulse width and signal pulse amplitude."

The Office Action correctly concludes that the Dierickx and Raynor combination does not teach or suggest these limitations. Therefore, the Office Action relies on Dierickx and Raynor in view of Ueno. However, as detailed above, the Dierickx and Raynor combination fails to teach or suggest other limitations of claim 1 from which claims 6 and 7 depend. Ueno does not cure the failings of Dierickx and Raynor. Therefore, the rejection of claims 6 and 7 should be withdrawn and the claims allowed.

Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Dierickx. The rejection is respectfully traversed.

Claim 15 depends from claim 12 and adds the further limitation that "said saturation control signals are respectively pulsed before the reset signals."

Claim 15 depends from claim 12 and is allowable along with claim 12 for at least the reasons stated above with respect to claim 12 and on its own merits. Therefore, the rejection of claim 15 should be withdrawn and the claim allowed.

Claims 19-23 and 37-42 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Pain et al. (U.S. Patent No. 7,002,626) ("Pain") in view of Dierickx. The rejection is respectfully traversed.

Claim 19 recites saturation control limitations similar to claim 1, but in a pixel circuit comprising an anti-blooming transistor. As the Office Action correctly acknowledges at page 10, Pain does not teach or suggest applying saturation control signals, as claimed by Applicants. Thus, the Office Action uses Pain in combination with Dierickx. However, for at least the reasons detailed above with respect to claim 1, Dierickx also fails to teach or suggest the method of claim 19. Moreover, the Pain pixel circuit is incompatible with, and therefore cannot be properly combined with, the Dierickx pixel circuit. The Pain pixel circuit relies on a transfer transistor to selectively couple photoactive regions to output regions. (Pain, Column 4, Lines 62-65) As detailed above, the Dierickx pixel circuit lacks a transfer transistor and is not compatible with the Pain circuit. For at least these reasons, the rejection of claim 19 should be withdrawn and the claim allowed.

Claims 20-23 depend from claim 19 and are allowable along with claim 19 for at least the reasons stated above with respect to claim 19 and on their own merits. Therefore, the rejection of claims 20-23 should be withdrawn and the claims allowed.

Claim 37 recites similar limitations as claim 19 and is allowable for at least the reasons stated above with respect to claim 19. Therefore, the rejection of claim 37 should be withdrawn and the claim allowed.

Claims 38-42 depend from claim 37 and are allowable along with claim 37 for at least the reasons stated above with respect to claim 37 and on their own merits. Therefore, the rejection of claims 38-42 should be withdrawn and the claims allowed.

Claims 24-30 and 43-53 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kochi (U.S. Patent No. 6,647,088) ("Kochi") in view of Dierickx. The rejection is respectfully traversed.

Claim 24 recites saturation control limitations similar to claim 1, but in a pixel circuit comprising first and second photodiodes. As the Office Action correctly acknowledges at page 14, Kochi does not teach or suggest applying saturation control signals, as claimed by Applicants. Thus, the Office Action uses Kochi in combination with Dierickx. However, for at least the reasons detailed above with respect to claim 1, Dierickx also fails to teach or suggest the method of claim 24. Moreover, the Kochi pixel circuit is incompatible with, and therefore cannot be properly combined with, the Dierickx pixel circuit. The Kochi pixel circuit relies on multiple transfer transistors 5-1, 5-2 to selectively couple photodiodes 1-1, 1-2 to a source-follower transistor 2. (Kochi, FIG. 1) As detailed above, the Dierickx pixel circuit lacks a transfer transistor and is not compatible with the Kochi circuit. For at least these reasons, the rejection of claim 24 should be withdrawn and the claim allowed.

Claims 25-30 depend from claim 24 and are allowable along with claim 24 for at least the reasons stated above with respect to claim 24 and on their own merits. Therefore, the rejection of claims 25-30 should be withdrawn and the claims allowed.

Claim 43 recites similar limitations as claim 24 and is allowable for at least the reasons stated above with respect to claim 24. Therefore, the rejection of claim 43 should be withdrawn and the claim allowed.

Claims 44-53 depend from claim 43 and are allowable along with claim 43 for at least the reasons stated above with respect to claim 43 and on their own merits. Therefore, the rejection of claim 44-53 should be withdrawn and the claims allowed.

In view of the above, Applicants believe the pending application is in condition for allowance and respectfully request that it be passed to issue.

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Respectfully submitted,

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